



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION 10

1200 Sixth Avenue, Suite 900
Seattle, WA 98101-3140

OFFICE OF
ENVIRONMENTAL REVIEW
AND ASSESSMENT

MEMORANDUM

SUBJECT: Additional Groundwater Comments to the Status on Fairchild PFAS Investigation and QAPP in the Former Fire Training Area FT004

FROM: Ted Repasky, Hydrogeologist
Office of Environmental Review and Assessment

TO: Kim Prestbo, Remedial Project Manager
Office of Environmental Cleanup

DATE: December 29, 2016

You requested a review the QAPP for the former fire training area FT004 as it relates to the remediation of the LNAPL jet fuel (JP-4). Information within this QAPP is also relevant to the proposed sampling for PFOA/PFAS at this site.

Although this area was remediated with both a soil removal action and with a bioventing remediation system, I think it would be useful to have water level fluctuations data for this site if it is available. This could help to show if there were seasonal changes that might have allowed both the jet fuel and the PFAS to remain in the deeper and shallower formations. Figure 10-2 (below) also shows areas in the soils inferred to have residual contamination present at concentrations above the PALs. These areas could also be a continuing source for the AFFF chemicals.

The geology of the area is described as alluvial silt, silty clays, sand, and gravel overlying the basalt bedrock. The alluvium coarsens from the fine-grained material in the upper 3-5 feet, down into the gravels which are over the bedrock with depth. The top of the basalt itself (top 50 feet) is vesicular and moderately fractured and highly weathered in places. These gravels and fractured/weathered basalts would have a higher hydraulic conductivity that would allow the groundwater to potentially transport contaminants down and away from the source of discharge, or act as a reservoir for the gradual release of PFCs. As noted in the document, the shallowest water-bearing interval at the site is within the alluvium and uppermost basalt at depths of 4 to 11 feet. From the water elevation data in the alluvial and shallow basalt wells, "*hydraulic continuity likely exists between these water-bearing units at the site*". This is why it is important to also sample from wells within this deeper aquifer.

One well is referenced in the document that appears to be an error. One page 12, under the section 10.4.3 Nature and Extent of Contamination, the discussion of benzene concentrations in wells a distance of 700 feet from the source, mentions wells MW-427 and MW-50. However, well MW-427 is located far to the north in the distal alluvial plume. Perhaps the well referenced is supposed to be MW-247?



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This QAPP mentions that residential wells RW-19 and RW-46 are downgradient and sampled annually for VOCs but not for TPH-D. If the wells are sampled annually, could samples also be collected for PFOA/PFOS analysis at the same time?

In the e-mail response from Kurt Lee regarding the previous request for sampling the deeper basalt formation, he mentions that although PFOA/PFOS are not technically LNAPL, AF experience is that AFFF behaves similar to LNAPL in that when AFFF makes its way through the soil and contacts GW, it tends to form a film/layer that migrates horizontally along the surface/top layer of GW. As mentioned in a presentation by Jason Conder, this may be true in high concentrations. However, a presentation by Hilary Thornton, Superfund Restoration and Site Evaluation Branch, U.S. Environmental Protection Agency Region 4, recommended against taking samples at only the surface of the water. Enough time has passed since the application of these chemicals that they may not be concentrated at just the surface of the unconfined aquifer. The highly mobile water-soluble nature of some phases of these chemicals was also confirmed in a telephone call to Dr. Nancy Rothman, and in presentations by Dr. Jennifer A. Field, Dr. Rula Deeb, and in a SERDP & ESTCP Webinar Series

Additionally, this site was remediated in the past via bioventing and had an air sparge curtain. As was noted by McGuire, et. al. (2014), in their studies, it appears that there were elevated ratios of perfluorohexanesulfonate (PFHxS) to PFOS in groundwater near oxygen sparging wells. There is a higher potential for the formation in situ of PFAA from precursors as a result of remedial activities (e.g., biosparging) which may also significantly impact the spatial distribution of PFASs in the subsurface at contaminated sites. Many PFAA precursors may be transformed to PFAAs if the subsurface microbial activity has been stimulated to enhance the natural attenuation of co-contaminants. This is an additional reason why the EPA would recommend sampling from multiple depths to determine if there has been stratification in the subsurface.

In the figures supplied by Kurt Lee for the existing wells proposed to be sampled for PFOA/PFOS (Figures 2 and 3, and Table 17-1), it appears that they include the following: MW-3, MW-50, MW-226, and MW-225. These locations are shown on Figure 18-1 below. Monitoring well construction for a few of the wells are listed in Worksheet #18 section 18.1.1. As can be seen by the construction information, these wells are completed in a very shallow interval.

Well Number	Depth (ft bgs)	Well Screen (ft bgs)
MW-3	9	4-9
MW-226	16	15-16
MW-247	15	5-15

However, Figure 10-4b (below) shows some additional wells completed in the basalt aquifer that may be suited for PFC sampling. This includes MW-156, MW-154, and MW-100. A complete list of wells with depths, screening intervals and formations in this area would help to assess additional wells suitable for sampling. I would not recommend the use of language that implies if PFOA/PFOS is not found in the shallow interval above HA levels near this fire training site,



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then it is unlikely that it was present in concentrations great enough to initiate investigation of domestic wells off-site. There could have been some flushing of the shallow, unconfined aquifer, or some vertical groundwater migration that could dilute the concentration values over time, while still have greater concentrations down-gradient.

Finally, because of the discrepancy between the Air Force and the Navy on the use of Rite in the Rain products and Sharpies, Dr. Rothman recommends field blanks be collected to monitor any possibility of cross contamination. The samples should also be analyzed for C4 and C5 precursors.

REFERENCE

McGuire, M. E., C. Schaefer, T. Richards, W. J. Backe, J. A. Field, E. Houtz, D. L. Sedlak, J. L. Guelfo, A. Wunsch, and C. P. Higgins, 2014, Evidence of Remediation-Induced Alteration of Subsurface Poly- and Perfluoroalkyl Substance Distribution at a Former Firefighter Training Area, American Chemical Society, Environmental Science & Technology Article, pp. 6644–6652



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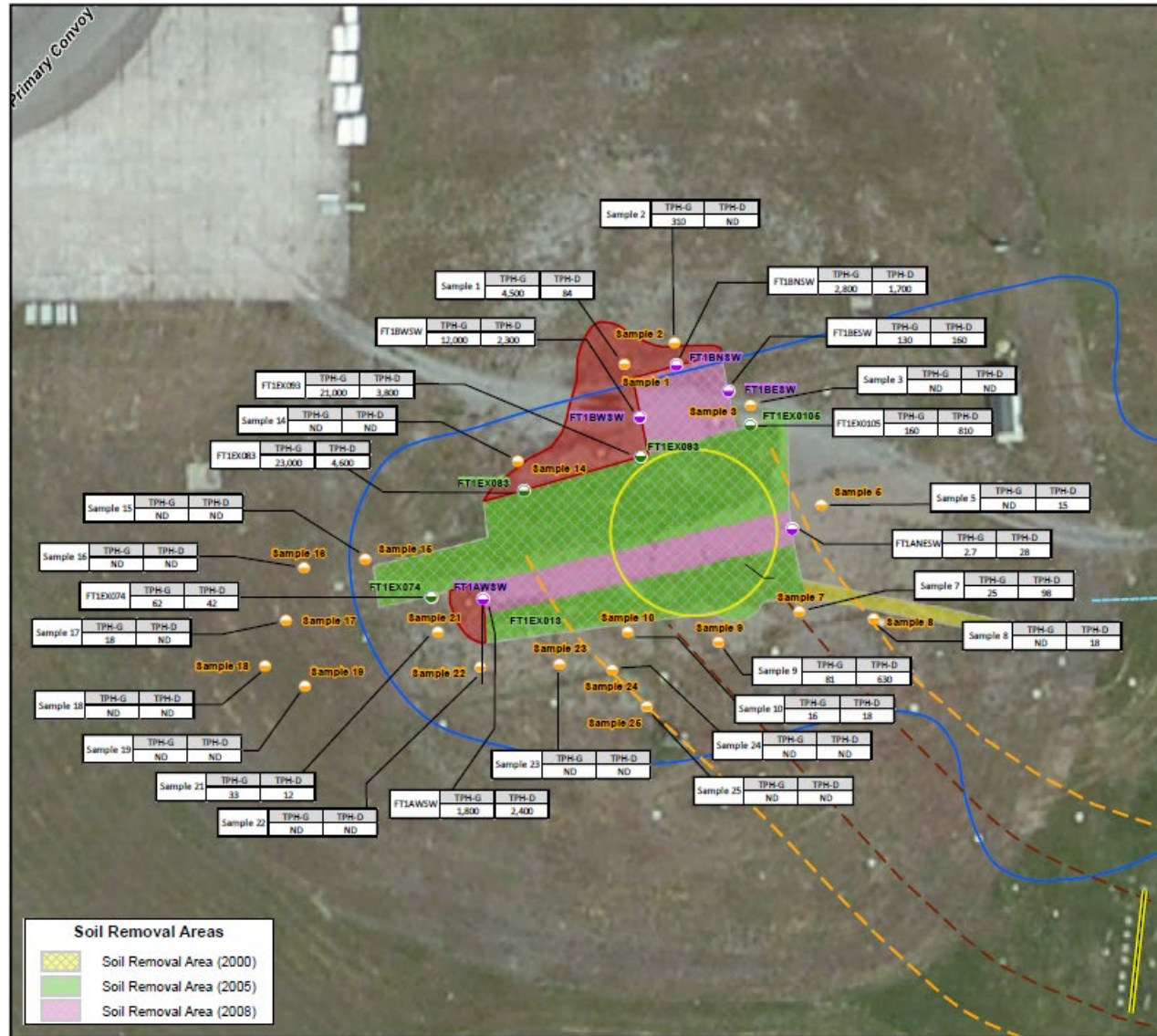


Figure 10-2
Fire Training Area (FT004)
Historical Soil Excavations
and Sampling Locations
Fairchild AFB, WA



Map Projection: NAD 1983 UTM Zone 11N, Meters
Datum: ESPS World Imagery WMS



- 2005 Soil Sample Location
- 2008 Soil Sample Location
- 2004 Soil Sample Location
- West Sparge Curtain
- Drainage Ditch
- 100 TPH-D Groundwater Contaminant Plume (µg/L) 2014 Data (Inferred)
- 500 TPH-D Groundwater Contaminant Plume (µg/L) 2014 Data (Inferred)
- Approximate Bioventing Area
- Former Burn Pit
- Installation Boundary
- Inferred Extent Of TPH-D or TPH-G Soil Concentrations Above The CULs
- Fire Training Area (FT004) Site Boundary

NOTES:
1) Analytical data not displayed for historical samples subsequently excavated in follow-up site work
2) ND - Non-detect
3) All results at in mg/Kg



Drawn By: SG Date Drawn/Revised: 10/15/2015 Project No.: J130130



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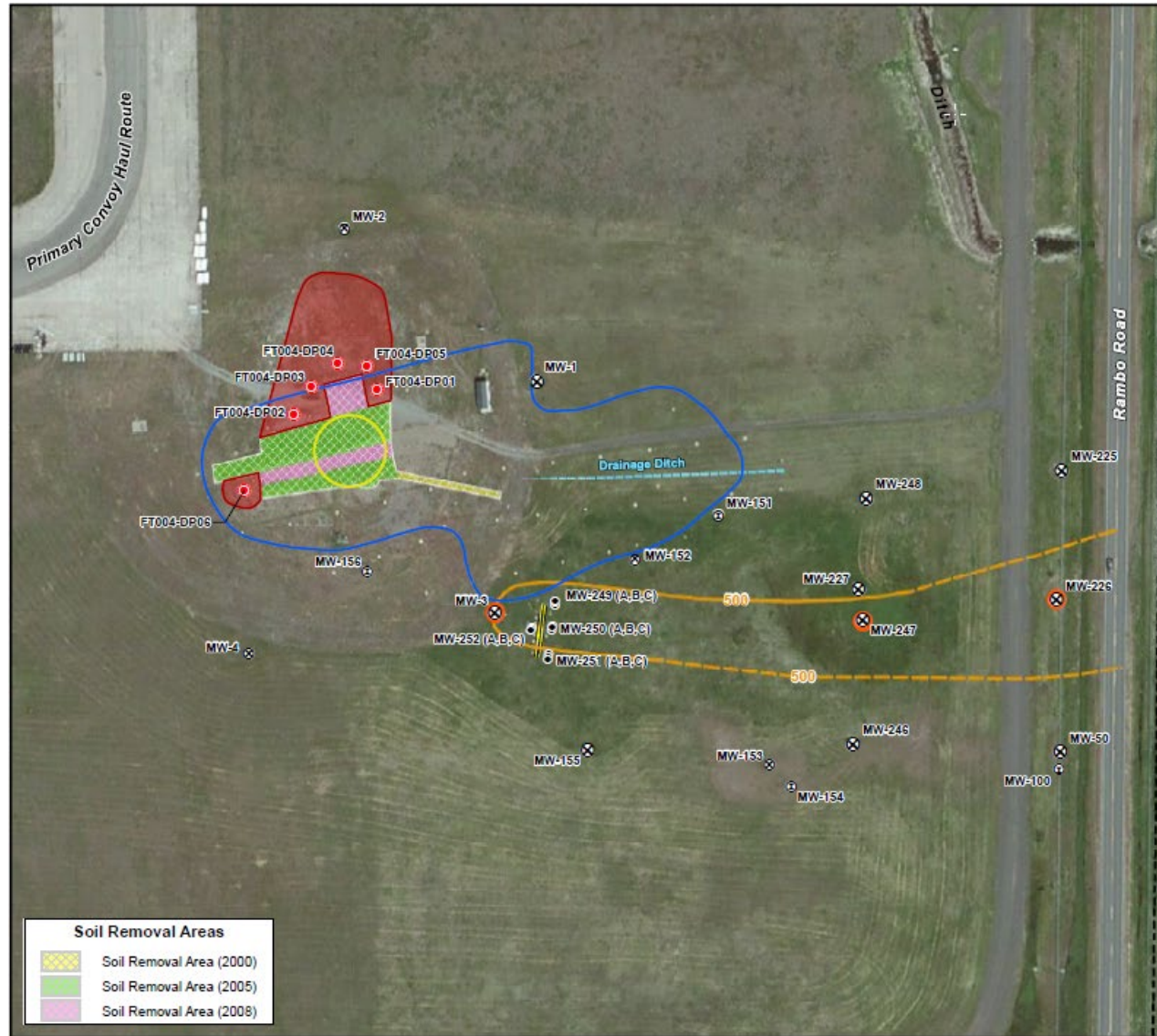
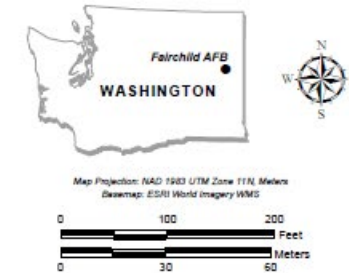


Figure 18-1
Fire Training Area (FT004)
Sample Location Map
Fairchild AFB, WA



- RA-0 Alluvial Aquifer Monitoring Well
- Alluvial Aquifer Monitoring Well
- Basalt A Monitoring Well
- Sparge Curtain Monitoring Well
- Proposed Direct Push Soil Boring
- Sampling Program Wells
- West Sparge Curtain
- Drainage Ditch
- TPH-D Groundwater Contaminant Plume (ug/L) 2014 Data
- TPH-D Groundwater Contaminant Plume (ug/L) 2014 Data (Inferred)
- Approximate Bioventing Area
- Former Burn Pit
- Installation Boundary
- Inferred Extent Of TPH-D or TPH-G Soil Concentrations Above The CULs
- Fire Training Area (FT004) Site Boundary



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